REMARKS/ARGUMENTS

Summary of the Examiner's Actions

The examiner objected to the title of the invention as not being descriptive. Applicants acknowledge this objection.

The examiner objected to Claims 1, 5, 9 and 17 due to informalities. Applicants acknowledge these objections.

The examiner rejected Claims 1-4, 6, 7 and 12-20 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,552,348 ("the '348 patent"), issued to Cherry *et al.* Applicants acknowledge the rejection under 35 U.S.C. § 102(b).

The examiner rejected Claim 5 under 35 U.S.C. § 103(a) as being unpatentable over the '348 patent, in view of U.S. Patent No. 5,091,650 ("the '650 patent"), issued to Uchida *et al.* Applicants acknowledge the rejection under 35 U.S.C. § 103(a).

The examiner rejected Claims 8-11 under 35 U.S.C. § 103(a) as being unpatentable over the '348 patent. Applicants acknowledge the rejection under 35 U.S.C. § 103(a).

Objections to the Specification

The examiner objected to the specification. Specifically, the examiner indicated that the title of the invention is not descriptive. The examiner required a new title that is "clearly indicative of the invention to which the claims are directed." Accordingly, as indicated above, the title of the present application has been amended to read "A Detector Array Using a Continuous Light Guide Disposed between the Detector Array and An Array of Photodetectors in Association with an Imaging Device." It is respectfully submitted that the examiner's objection to the specification has been overcome.

Objections to the Claims

The examiner objected to Claims 1, 5, 9 and 17 for various informalities. Specifically, with respect to Claim 1, the examiner indicated that the antecedent basis for "said scintillator" and "said at least one array of scintillator elements" is unclear. Claim 1 has been amended to overcome such rejection. To wit, "said scintillator" has been amended to read --said scintillator elements-- and "said at least one array of scintillator elements" has been amended to read --said at least one M x N array of scintillator elements-- (lines 6 and 10-11). Further, "said array of scintillator elements" has been amended to read --said at least one M x N array of scintillator elements-- to conform to the previous amendments.

With respect to Claim 5, the examiner indicated that the antecedent basis for "said reflective light partition" is unclear. Claim 5 has been amended to overcome such rejection. Specifically, "no said reflective light partition" has been amended to read --none of said plurality of reflective light partitions--.

With respect to Claim 9, the examiner indicated that the antecedent basis for "said side wall" is unclear. Claim 8, from which Claim 9 depends, has been amended to overcome such rejection. Specifically, Claim 8 has been amended to include the limitation of --each of said plurality of scintillator element cells defining a side wall--.

With respect to Claim 17, the examiner indicated that the antecedent basis for "said reflective light partition" is unclear. Claim 17 has been amended to overcome such rejection. Specifically, "no said reflective light partition" has been amended to read --none of said plurality of reflective light partitions--.

Rejections under 35 U.S.C. § 102(b)

Section 2131 of the Manual of Patent Examining Procedure describes the basis for anticipation under 35 U.S.C. § 102. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim. *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990).

The examiner rejected Claims 1-4, 6, 7 and 12-20 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,552,348 ("the '348 patent"), issued to Cherry *et al.* Specifically, the examiner stated:

> With respect to 1, Cherry et al disclose a detector array for use in association with an imaging device, said detector array comprising: at least one MxN array of scintillator elements (4) where "M" and "N" are independently selectable and where "M" and "N" are at least one; a mechanism (grid array 18 and/or optical grease, and/or PTFE tape, see col. 8-9) for maintaining a relative position of each element in said scintillator elements array; said array of scintillator elements being optically coupled to at least one photodetector (8, a photomultiplier tube); a continuous light guide (12), defining no discontinuities including cuts and slots, disposed between said at least one array of scintillator elements and said at least one photodetector; each of said scintillator elements defines a top surface, a bottom surface, and a plurality of side surfaces (fig. 3); a plurality of reflective light partitions (reflective material ($BaSO_4$ powder) and/or PTFE tape, see col. 8, lines 50-67), interposed between said scintillator elements, wherein at least one of said plurality reflective light partitions defining a first height, and at least one of said plurality of reflective light partitions defining a second height(note that each of the reflective material and/or PTFE tape defines a height). Furthermore, the outer side of the adjacent pairs of said scintillator elements in said array of scintillator elements is being wrapped by PTFE tape (col. 9, lines 1-10) with an air gap being defined between the PTFE tape and opposing sides of the adjacent pair of said scintillator elements (note that five sides not coupled to said photodetector and/or said light guide of each said scintillator elements are coated with reflective light partitions, $BaSO_4$ powder).

Applicants respectfully disagree with the examiner's reading of the '348 patent. Specifically, the examiner has read the '348 patent as teaching "a continuous light guide (12), defining no discontinuities including cuts and slots, disposed between said at least one array of scintillator elements and said at least one photodetector; ...." However, what Cherry *et al.*, have disclosed, at col. 7, lines 16-17 and 20-21, a "lightguide **12**, such as an optical fiber bundle." Various configurations of lightguides are described and illustrated by Cherry *et al.*. However, none is provided for coupling the scintillators to more than one photodetector.

Attention is drawn to col. 9, lines 19-28, where Cherry *et al.*, discuss the problem of having a crystal array larger than the active area of a PMT. A taper from 3x3 cm^2 to 2x2 cm^2 was needed to accomplish the '348 invention. At col. 9, lines 33-37, cherry *et al.*, specifically set forth that "A further constraint to overcome was that the surface area of the lightguide **12** should be no larger than 3x3 cm^2, so that multiple individual detector modules **20** can be tiled together into a larger detector array." This is also clearly illustrated in the figures. See Figs. 1B, 5A and 5B, wherein the lightguide 12 is illustrated in broken lines. Fig. 1B clearly shows a lightguide for each photodetector, the lightguides being independent, and therefore discontinuous, of each other lightguide.

Cherry *et al.*, disclose various described embodiments of the lightguide of the '348 invention. Among these include:

- Example 2: A lightguide 12 constructed from B-270 glass ... cut into individually tapered lightguides 12 ... (FIG. 4b). ... The dimensions of the lightguide 12 were cut so that one side would match the scintillation crystal array (about 3 cm) and the other side would match the active face of the PMT (about 2 cm). (see Col 9., lines 58-66)
- Example 3: A conventional optical lens ... was utilized. A central square section of size about 30 cm^2 [sic] was cut out of a plano-concave (PCV) lens of diameter about 50.0 mm and having an effective focal length of about -100.0 mm (FIG. 4c). (see col. 10, lines 5-9)
- Example 4: A set of nine, double-clad optical fibers ... about 2 mm diameter and about 5.3 cm long were utilized (FIG. 4d). (see col. 10, lines 16-18)
- Example 5: A tapered fiber bundle ..., as shown in FIG. 4e, was used. The optical fiber bundle was a coherent bundle composed of many thousands of micron diameter glass fibers fused together. To allow

> detector modules 20 to be tiled together, the larger end of the fiber taper, FIG. 4e, was cut into about a 3x3 cm square to match the physical dimensions of the PMT and the LSO array, as shown in FIG. 4f. The taper was made from thousands of 10 micron diameter glass fibers that were vacuum fused and then drawn out to form the tapered end while maintaining spatial coherence of the light. (see col. 10, lines 30-40)

In each embodiment, a single detector block is coupled to a single photodetector.

In the present application, as set forth in Claim 1 as originally presented, a continuous light guide is disposed between an array of scintillator elements and at least one photodetector. The continuous light guide defining no discontinuities including cuts and slots. It is clear from the descriptions given in the '348 patent that the lightguide is not continuous. In example 2, the lightguide is cut into individually tapered lightguides, which is clearly teaching away from the present invention as claimed. In example 3, the lightguide defines a concavity on one side thereof for engaging the end of the photodetector. In examples 4 and 5, the lightguide includes from nine to "many thousands" of optical fibers. It is respectfully submitted, therefore, that Cherry *et al.*, do not teach the use of a continuous light guide. As a result, Cherry *et al.*, do not teach the used of a continuous disposed between an array of scintillator elements and at least one photodetector, especially in the typical case where there is an array of photodetectors.

Notwithstanding the deemed patentable distinctions between the present invention as originally claimed, independent Claims 1 and 15 have been amended to more clearly define "at least one photodetector" as --an array of photodetectors--. Claims 12 and 13, each depending from Claim 1, and Claims 18 and 19, each depending from Claim 15, have been amended according to the amendments of Claims 1 and 15. It is respectfully submitted that Cherry *et al.*, do not teach a lightguide coupled to more than one photodetector, regardless of whether the lightguide is continuous.

Accordingly, it is respectfully submitted that the examiner's rejections under 35 U.S.C. § 102(b) have been overcome. Having no further rejection of or objection to Claims 1-4, 6, 7 and 12-20, each is deemed to be in condition for allowance.

Rejections under 35 U.S.C. § 103(a)

In order to support a rejection under 35 U.S.C. § 103(a), "the examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness." MPEP § 2142, pg. 2100-121, 8th ed. "To reach a proper determination under 35 U.S.C. § 103(a), the examiner must step backward in time and into the shoes worn by the hypothetical 'person of ordinary skill in the art' when the invention was unknown and just before it was made." *Id.* The first element in establishing a *prima facie* case of obviousness is that "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings." MPEP § 2143, pg. 2100-122, 8th ed. The second element is that there "must be a reasonable expectation of success." *Id.* The third element is that "the prior art reference (or references when combined) must teach or suggest all the claim limitations." *Id.*

The relevant facts for finding obviousness relate to (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of nonobviousness such as long felt need, commercial success, the failure of others, or copying. *Graham v. John Deere Co.*, 148 U.S.P.Q. 459, 467 (1966; *see Continental Can Co. v. Monsanto Co.*, 20 U.S.P.Q.2d 1746, 1750-51 (Fed. Cir. 1991). The Supreme Court in *Graham* stated that "the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved." *Graham*, 383 U.S. at 17, 148 U.S.P.Q. at 467. The *Graham* court further stated that "[s]uch secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy." *Id.*

The examiner rejected Claim 5 under 35 U.S.C. § 103(a) as being unpatentable over the '348 patent, in view of U.S. Patent No. 5,091,650 ("the '650 patent"), issued to Uchida *et al.* Specifically, the examiner stated:

> With respect to claim 5, per the above discussion, note that Cherry et al disclose said air gap is defined between said scintillator elements and said plurality of reflective light partitions, but Cherry et al fail to disclose said air gap is defined between adjacent of said scintillator elements between which no said plurality of reflective light partitions are positioned.
>
> Uchida et al disclose a radiation detecting system using scintillator array with an air gap is defined between adjacent of scintillator elements between which no said reflective light partition is positioned(rough surfaces), and between said scintillator elements and said plurality of reflective light partitions (mirror-polished surfaces).
>
> Although Cherry et al lack a clear teaching of said air gap being defined between adjacent of said scintillator elements between which no said reflective light partition is positioned, by making portions of said scintillator elements without having said plurality of reflective light partitions been interposed in between is known in the art in order to provide an attenuation of a scintillation light through a distributing process in which the scintillation light generated in one of said scintillator elements is distributed to the other said scintillator elements.
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Cherry et al accordingly with the configuration of scintillator elements taught by Uchida in order to provide more control to the light-transmissivity between the adjacent of said scintillator elements.

In view of the deemed allowability of Claim 1 as discussed above, it is respectfully submitted that the examiner's rejection of Claim 5 under 35 U.S.C. § 103(a) has been overcome.

The examiner rejected Claims 8-11 under 35 U.S.C. § 103(a) as being unpatentable over the '348 patent. Specifically, the examiner indicated:

> With respect to claim 8, per the above discussion, Cherry et al disclose a grid array (18) defined by said mechanism for maintaining a relative position of each of said scintillator elements in said at least one array of scintillator elements with respect to each other of said scintillator elements and said plurality of reflective light partitions, said grid array defining a plurality of scintillator element cells adapted to receive said array of scintillator elements but fail to disclose the grid array being fabricated from a material selected to maximize light reflection at a wavelength particular to said scintillator elements.
>
> Although Cherry et al lack a clear teaching of the grid array being fabricated from a material selected to maximize light reflection at a wavelength particular to said scintillator elements, selecting a specific type of material to make the grid array to maximize light reflection at a wavelength particular to said scintillator elements would have been obvious to one of ordinary skill in order to provide a better reflectivity of the grid array.
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Cherry et al accordingly in order to prevent the light being absorbed by the grid array.
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> With respect to claim 9, per the above discussion, Cherry et al disclose using the grid array to hold the scintillator elements in place ([0053]), but fail to specify whether a binding agent is utilized or not, and Cherry et al fail to clearly specify if the air gap is being defined between each said scintillator element and said side wall of said scintillator element cell.
>
> Although Cherry et al lack a clear teaching of said at least one array of scintillator elements are received within each of said scintillator element cells without a binding agent and the air gap is being defined between each said scintillator elements and said side wall of said scintillator element cells, receiving said at least one array of scintillator elements within each of said scintillator element cells without using binding agent and having said air gap

> being defined between each said scintillator element and said side wall of said scintillator element cell would have been obvious to one of ordinary skill in the art in order to provide a easier removal and/or replacement of said scintillator elements.
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Cherry et al accordingly in order to provide an easier separation and/or removal of said scintillator elements when a replacement and/or a calibration of said scintillator elements is needed.
>
> Claim 10 would have been obvious for similar reasons set forth in the discussion of claim 8 above.
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> Claim 11 would have been obvious for similar reasons set forth in the discussion of claim 8 above.

In view of the deemed allowability of Claim 1 as discussed above, it is respectfully submitted that the examiner's rejection of Claims 8-11 under 35 U.S.C. § 103(a) has been overcome.

Notwithstanding the deemed allowability of Claims 8-11, it is respectfully submitted that Cherry *et al.*, do not disclose the grid array of the present invention. In the Cherry *et al.*, patent relates to a dedicated breast cancer imaging system using Positron Emission Tomography (PET). During the development of the '348 system, a process was developed for assembling detector arrays using LSO scintillator elements which were placed in a stereolithographed grid as described in the '348 patent (Col. 9, lines 1-12), as well as the doctoral dissertation of Dr. Niraj K. Doshi, *Design and Development of a Dedicated Mammary and Axillary Region Positron Emission Tomography System {maxPET}*, 2000, along with a paper entitled, "Design and evaluation of an LSO PET detector for breast cancer imaging," published in Medical Physics in July 2000, co-authored by Dr. Doshi and his colleagues, including Dr. Cherry. The following, available from all the aforementioned references, explicitly describes the fabrication of the scintillator array used:

To form the array, a plastic grid was used in order to hold the chemically polished crystals in place.

Once the crystals are placed in the grid, the 300 μm gap between the crystals is filled with a slurry of $BaSO_4$ powder and methanol in a 1:1 mixture by weight.

There was no anticipation, nor the intent to use the grid array to retain the individual scintillator elements other than for the initial purpose of defining a spacing between the individual elements for being filled with the slurry. In contrast, the detector array being described as the invention in this application relies upon a grid array being used independently of any other reflector material or scintillator retainer.

Summary

In view of the amendment of the title, the amendment of Claims 1, 5, 8, 12, 13, 15 and 17-19, and the arguments presented herein, it is believed that the above-identified patent application is in a condition for the issuance of a Notice of Allowance. Such action by the examiner is respectfully requested. If, however, the examiner is of the opinion that any of the drawings or other portions of the application are still not allowable, it will be appreciated if the examiner will telephone the undersigned to expedite the prosecution of the application.

Please charge any additional fees associated with this communication, or credit any overpayment, to Deposit Account No. 16-1910.

Respectfully submitted,
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